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NEUROLOGICAL AND MEDICAL FACTORS DISCRIMINATING BETWEEN NORMAL CHILDREN AND THOSE WITH LEARNING DISABILITY.

BY- FORREST, THOMAS

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COMPREHENSIVE NEUROLOGICAL EXAMINATIONS WERE ADMINISTERED TO THE 264 CHILDREN DIVIDED INTO FOUR GROUPS--EDUCATIONALLY HANDICAPPED (EH), SUCCESSFUL ACADEMIC (SA) CONTROLS, AND THE SIBLINGS OF EACH GROUP (EHS AND SAS). ON SEVERAL MEASURES AND TASKS THE EH CHILDREN WERE DIFFERENTIATED FROM THE SA CHILDREN, AND STRONG SIMILARITIES WERE ALSO FOUND BETWEEN SIBLINGS. THE NEUROLOGICAL FACTORS WHICH DIFFERENTIATED EH FROM SA CHILDREN WERE--TAPPED PATTERNS, RIGHT-LEFT DISCRIMINATION, DOUBLE SIMULTANEOUS TOUCH, AND FAST ALTERNATING FINGER AND HAND MOVEMENTS. THE TESTS WHICH SHOWED NO DIFFERENCES WERE--MEASURES OF HAND, FOOT, AND EYE PREFERENCE, AND ADVENTITIOUS OVERFLOW MOVEMENT, THE ARM EXTENSION TEST, AND THE WALKING ON BALANCE BEAM TEST. MEDICAL HISTORIES THROUGH PARENT-PHYSICIAN INTERVIEWS WERE ALSO OBTAINED. BASED ON THESE DATA, DIFFERENCES WERE FOUND BETWEEN THE EH AND SA CHILDREN IN THESE AREAS--IRRITABILITY DURING INFANCY, COLIC, DECREASED SOUND PRODUCTION DURING PRELINGUAL DEVELOPMENT, POOR LISTENING SKILLS AFTER AGE TWO, EASE OF MOTHER-CHILD COMMUNICATION, AND TEMPER TANTRUMS. THIS PAPER WAS PREPARED FOR PRESENTATION AT THE SRCD MEETING IN NEW YORK, MARCH 31, 1967. (DK)

NEUROLOGICAL AND MEDICAL FACTORS DISCRIMINATING BETWEEN NORMAL CHILDREN AND THOSE WITH LEARNING DISABILITY

Thomas Forrest

Stanford School of Medicine
and
Palo Alto Unified School District

This report concerns itself with two aspects of our study. I will discuss some measures and tasks performed in the neurological examination which differentiated the Educationally Handicapped (EH) children from their more successful academic (SA) controls. I shall also indicate some of the areas where our findings show strong similarities between siblings.

A comprehensive neurological examination was administered to all subjects by the same examiner. It included a classical examination of cranial nerves, motor power and tone, reflexes, cerebellar and sensory functioning, posture and motility, right-left discrimination, laterality, extinction to simultaneous tactile stimulation, ability to imitate tapped patterns and examination of selected physical characteristics such as variations of size, form and symmetry of the external ears. The three groups of subjects examined consisted of 76 EH children, 76 of their siblings (EHS) and 76 (SA) controls. Although medical histories were obtained on the fourth group, SAS or control sibs, neurological examination of this group was not planned as part of our study. However, time did permit examination of 36 of these children

Preliminary analysis of the information obtained from these examinations shows that the following measures significantly distinguished the educationally handicapped children from their controls.

Auditory tapped patterns have been used by Birch (1966), De Hirsch (1966), and others to study and predict behavior and learning disabilities.

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In our study the child was asked to reproduce patterns which were tapped on the examining table by the examiner's hand as he sat next to the child. The child was allowed to watch if he chose to do so. Each child had two trials to reproduce five patterns and one point was scored for each miss. The higher the score the greater the disability.

Examination of Figure I reveals significant discrepancies between EH subjects and SA children. Patterns reproduced by EH sibs show that in the younger age children (left half of graph) better performance by EHS than EH children was elicited. SA, or controls, had the best scores. In the young group of EH children, their school-age sibs were older and therefore showed better scores. When their age difference is taken into account, the disability of EH and EH sibs is remarkably similar. This is graphically demonstrated in the right half of the graph. Here, as the EH children get older, scores of the EH children and their sibs approximate each other. It is also of interest that this task showed a close correlation to the digit span score of the WISC which, as discussed by Dr. Adams, showed similar diagnostic and familial importance.

Figure II represents in a similar fashion the results of a double simultaneous tactile stimulation task. This task was a modification of one described by Pollack and Goldfarb (1957). EH children show significantly higher disability scores than the SA. Again, EH and EH sibs show a similar pattern.

Figure III shows the scores obtained from testing Right and Left discrimination. Children were asked to perform tasks with their R or L hand, or identify the examiner's right hand as he faced the child. Again, disability scores of EH and EH siblings fall higher than control subjects and significantly differentiate EH and SA children. Similar findings have been reported by Belmont and Birch (1965).

Fast alternating finger and hand movements were performed by asking subjects to imitate rapid finger and hand movements as customarily done in testing cerebellar functioning. These tasks also discriminated the two groups.

The tasks which did not discriminate EH and SA children are listed in Table I. Hand, foot and eye preference was estimated by using the Harris Test of Lateral Dominance. Adventitious overflow movements and arm extension refer to variations in posture and motility which are observed when a child is asked to close his eyes and maintain arm extension for a given period of time. Significant findings have been reported by Silver (1960), Prechtl (1962) and others but were not found to discriminate our groups. Walking on beams to estimate balance also did not differentiate between EH and SA subjects.

These negative findings, however, raise interesting questions. It is possible that by controlling for IQ, sex and age, as we did, we eliminated variables which have led to significant findings in other populations. It is also probable that some of these tests are age - dependent and are more valuable at specific and over rather narrow age ranges. In our population there were too few children of any one age to analyze the data in this fashion. Furthermore, clinical observations on tests of posture and motility are not easy to reduplicate or score. The problem of developing more precise measures of motor functioning continues to be an intriguing one.

Medical histories obtained through parent - physician interviews have often been criticized for their retrospective nature. As mentioned previously by my colleagues, more objective evidence was obtained by reviewing school and hospital records. It should be pointed out that in our population many mothers had recorded their children's developmental data and therefore the reliability of parent information gathered seemed relatively high.

Dr. Owen has already mentioned the accumulating information on twin studies which was one of the factors focusing our interest on a familial study. As you have heard, review of high school transcripts revealed significantly lower English grades in parents of EH children than in SA controls. These findings were confirmed independently by mothers of educationally handicapped children. Twenty-two mothers reported learning difficulties during their own school years; eighteen mothers reported that their husbands had learning difficulties in school. Only four mothers in the SA families stated they had school difficulties and identified their husbands to have had learning difficulties in nine cases. (Figure IV)

Another source of information on speech and language development on our population was available to us. In the Palo Alto school system all children receive a speech evaluation upon entering school, usually at the kindergarten level. Those children identified as having significant speech and language variations are enrolled in the speech program, receive therapy and long-term follow-up. We are indebted to Ruth Jackson, coordinator of this program, and to her staff for supplying us with the information shown in Figure V. This figure shows a significantly higher incident of speech and language variation in the EH population. This coincides with other surveys which have shown that children with reading difficulties in the Palo Alto School District were found to have speech problems in over 50% of the cases. A breakdown of the type of speech difficulties in our population will be discussed at a future time.

An increasing body of evidence also forced us to consider the possibility that neurological abnormalities are important factors in learning and adaptive behavior. Therefore, we scrutinized past medical histories obtained from parents as well as hospital records. Hospital prenatal and birth records were obtained in over 75% of our population.

We did not find that possible prenatal, neonatal or postnatal complications were significantly more frequent in the EH population. Our population had very few premature births and no relationship to birth weight was found. However, in individual cases, the direct relationship of such complications to neurological abnormality is apparent.

If one adopts the hypothesis that structural neurologic abnormality is a significant etiological factor in causing learning disability, then it seems justified to examine those children with definitive evidence of specific neurologic abnormality to determine their type of learning disability.

In our study of the 264 subjects examined, only four children were found to have definitive signs of neurologic abnormality. Three were EH children and one was a SA child. Figure VI shows the WISC scores of these four children and their siblings. ("V" designates verbal, "P" performance scores.) Three of the four brain injured children had lower performance than verbal scores. In each case the more normal sib showed a similar discrepancy. When compared to their sibs, full scale IQ's were lower in the three neurologically affected EH children. The brain damaged SA child had a similar IQ to her sib.

If WISC scores reflect something about educability and cognitive or perceptual style, then it seems obvious from the examination of this slide that neurological damage per se in those affected individuals is not the sole or possibly even the major factor in determining cognitive style. Nor does it necessarily limit educability. The point is that clinical observations are far from being specific enough to tell us how a child learns. Specific diagnosis of educational problems will elude us for a while longer. However, it is our hope that clinical observations <u>can</u> lead to better prevention of these problems.

Before closing, I would like to return for a minute to the medical histories. In an attempt to glean further insights into linguistic and adaptive behavior, the following historical factors were found to differentiate significantly the EH and SA control (Table I). The two factors which best discriminated the two groups were #4 and #5. In #4 each mother was asked whether she read stories to her children. Most mothers gave affirmative responses. They were then asked if there was any difference in their son's or daughter's abilities to sit and listen. The mothers of 20 EH families reported poor attention in one or both of their children. Only five SA mothers stated that their children could not sit and listen. In item #5 mothers were asked, "Which child do you find it easier to talk to?" Twenty-eight (28) mothers reported a difference between the EH and his EH sibling: in 26 cases the EH child was more difficult to talk to than his sib. Only six SA mothers stated that one sibling was easier to talk to than the other.

The present effort to define factors which underlie learning problems in children is based on the hypothesis that neurological organization is a result of genetic and environmental factors. Therefore, it is not surprising that familial similarities are evident. We anticipate that future analysis of factors within subgroups of our population will show interesting patterns and relationships.

Bibliography

Belmont, L., and Birch, H.G. Lateral Dominance, Lateral Awareness and Reading Disability. Child Development. March 1965, Vol. 36, #1.

de Hirsch, K., Jansky, T., and Langford, W., Predicting Reading Failure. Harper and Row, New York, 1966.

Hertzig, M.E., and Birch, H.G. Neurological Organization in Psychiatrically Disturbed Adolescent Girls. Arch. Gen. Psychiatry. December 1966, Vol. 15, pp. 590-598.

Pollack, M., and Goldfarb, W. The Face Hand Test in Schizophrenic Children. Arch. of Neurology and Psychiatry. #77, pp. 635-642, 1957

Prechtl, H.F.R., Stemmer, Ch. J. The Choreiform Syndrome in Children Developmental Medicine and Child Neurology. 1962, #4, pp. 119-127.

Silver, A., and Hagin, R. Specific Reading Disability: Delineation of the Syndrome and Its Relationship to Cerebral Dominance, Comprehensive Psychiatry 1 (2), pp. 126-134, 1960.

Figure 1.

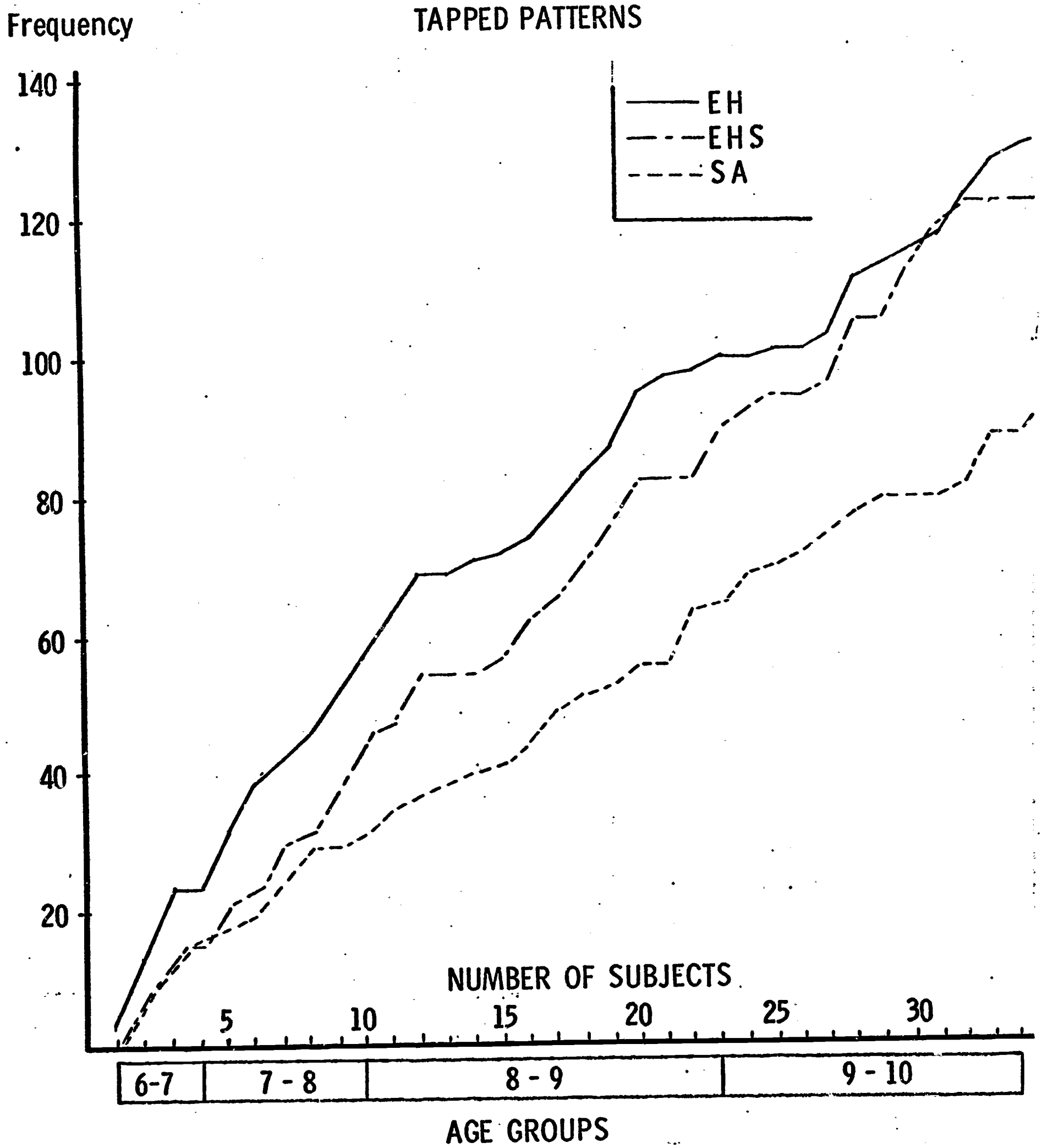

TAPPED PATTERNS
Frequency
140
120
100
80
60
40
20
EH
EHS
SA
NUMBER OF SUBJECTS
5
10
15
20
25
30
6-7
7 - 8
8 - 9
9 - 10
AGE GROUPS

Figure 11.

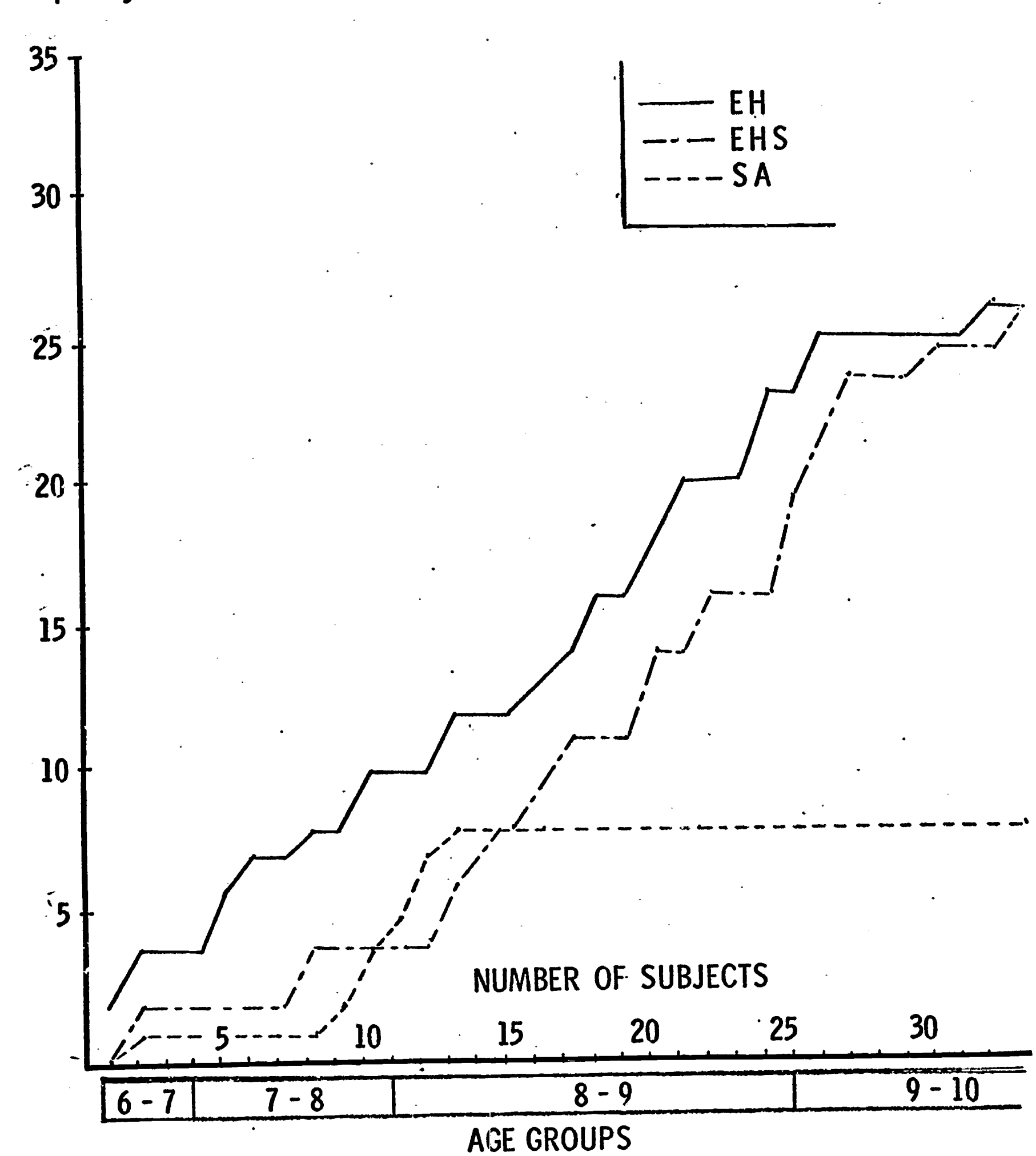
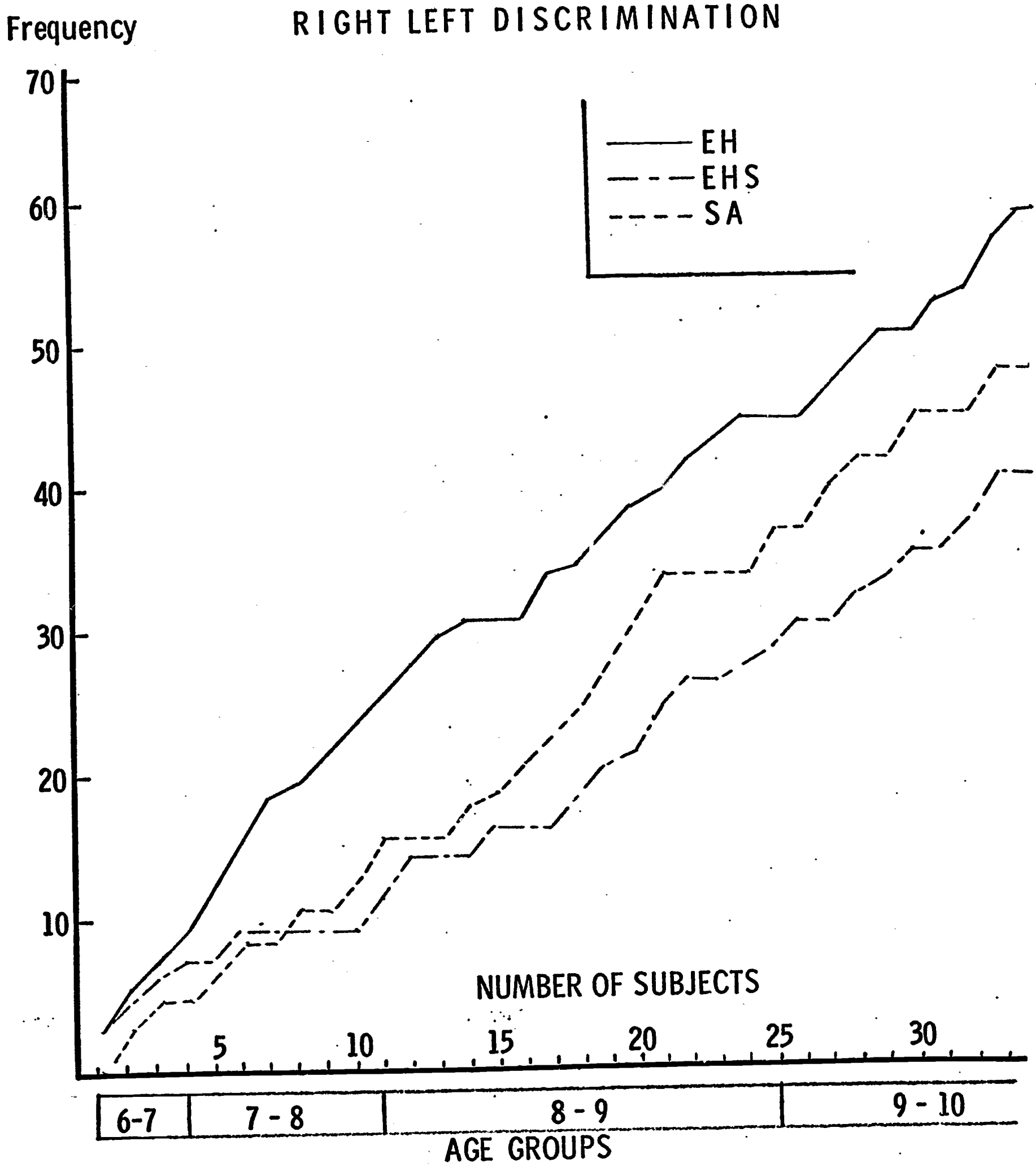
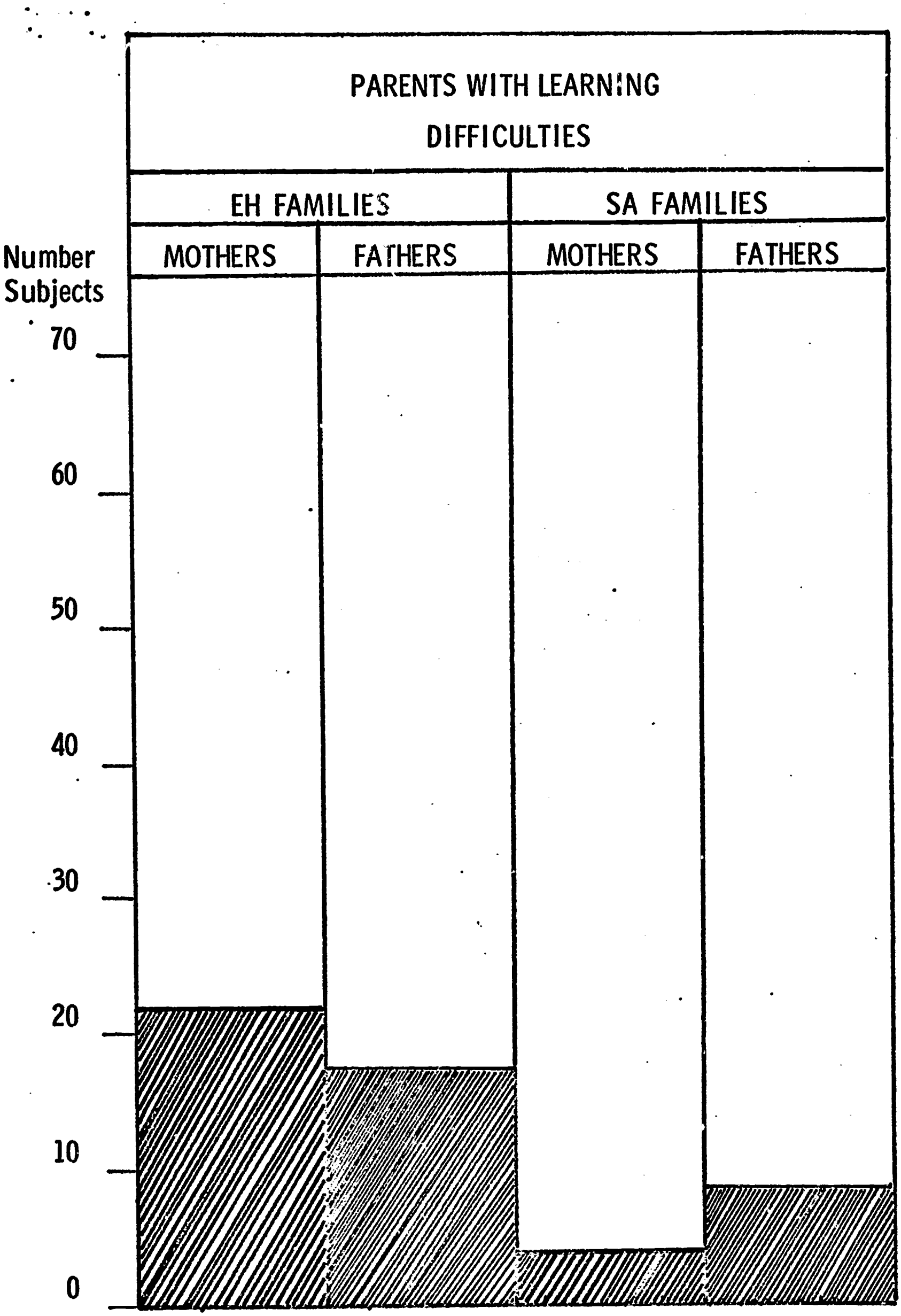
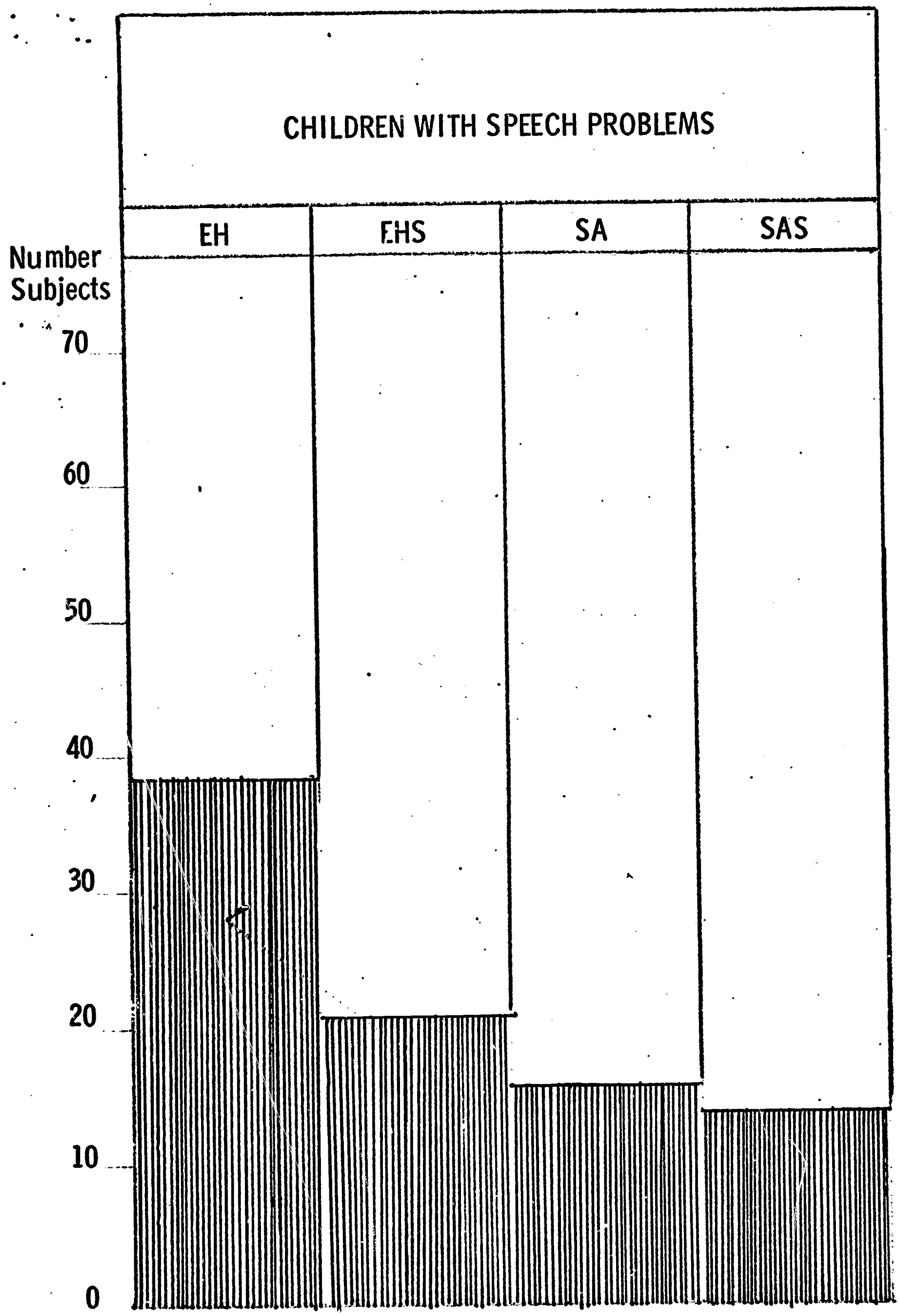

Frequency
DOUBLE SIMULTANEOUS TOUCH
EH
EHS
SA
35
30
25
20
15
10
5
5
10
15
20
25
30
NUMBER OF SUBJECTS
6 - 7
7 - 8
8 - 9
9 - 10
AGE GROUPS

Figure III.

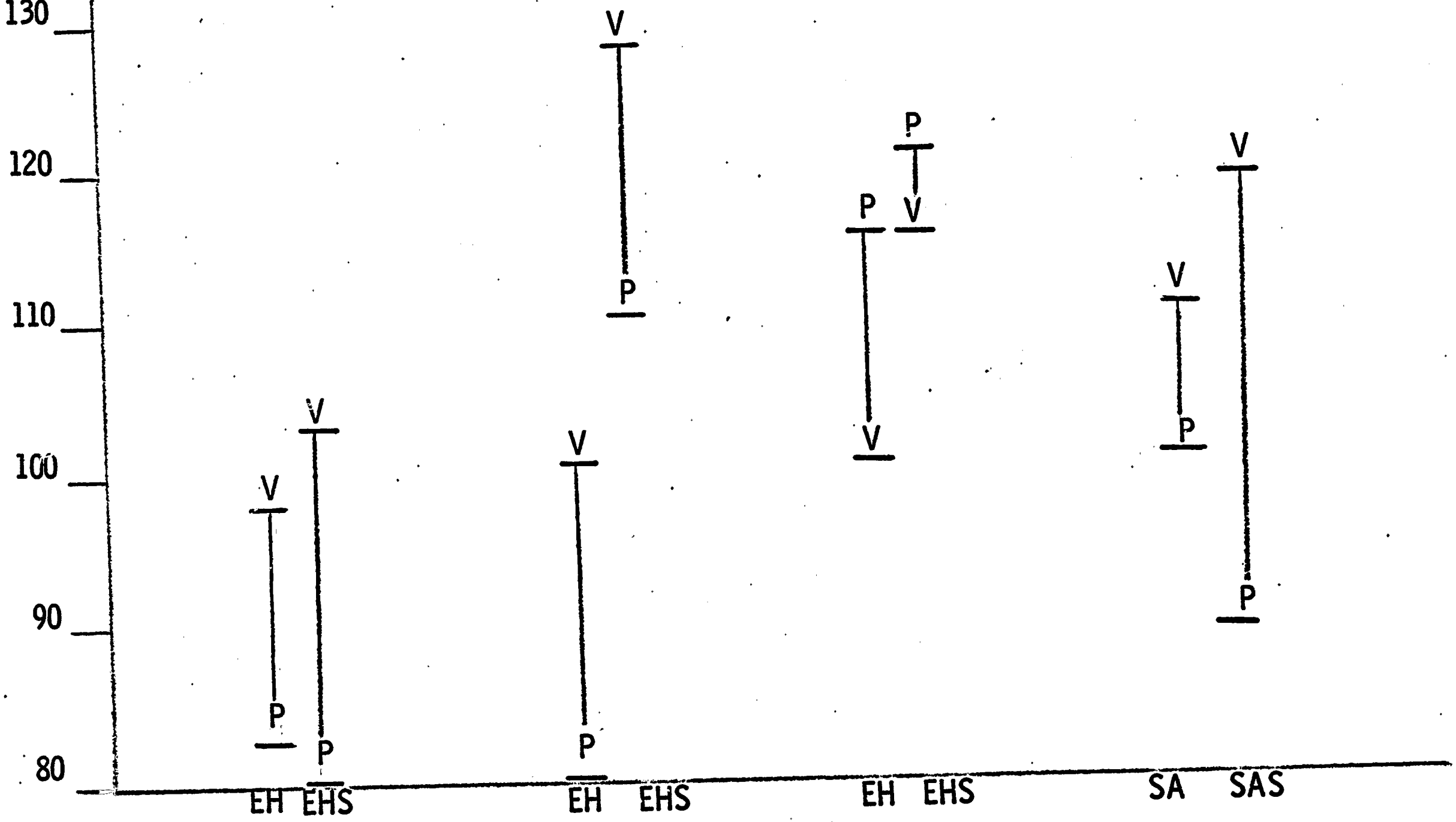

RIGHT LEFT DISCRIMINATION
Frequency
70
60
50
40
30
20
10
EH
EHS
SA
NUMBER OF SUBJECTS
5
10
15
20
25
30
6-7
7 - 8
8 - 9
9 - 10
AGE GROUPS


PARENTS WITH LEARNING DIFFICULTIES
EH FAMILIES
SA FAMILIES
MOTHERS
FATHERS
MOTHERS
FATHERS
Number Subjects
70
60
50
40
30
20
10
0


CHILDREN WITH SPEECH PROBLEMS
EH
EHS
SA
SAS
Number Subjects
70
60
50
40
30
20
10
0

WISC SCORES

WISC SCORES
SUBJECTS WITH DEFINITIVE NEUROLOGIC DEFICIT COMPARED TO THEIR MORE NORMAL SIBS



HISTORICAL FACTORS DIFFERENTIATING EH AND SA SUBJECTS:

1. Irritability during infancy
2. Colic
3. Decreased sound production during prelingual development
4. Poor listening skills after age two
5. Ease of mother-child communication
6. Temper tantrums

FACTORS DIFFERENTIATING EH AND SA SUBJECTS:

1. Tapped patterns
2. Right - Left discrimination
3. Double simultaneous touch (face-hand test)
4. Fast alternating finger and hand movements

FACTORS NOT DIFFERENTIATING EH AND SA SUBJECTS:

1. Measures of hand, foot and eye preference
2. Adventitious overflow movement
3. Arm extension test
4. Walking on balance beam

TABLE I

HISTORICAL FACTORS DIFFERENTIATING EH AND SA SUBJECTS:

1.	Irritability during infancy	$\chi^2 = 4.19$ p $< .05$
2.	Colic	$\chi^2 = 4.99$ p $< .05$
3.	Decreased sound production during prelingual development	$\chi^2 = 4.14$ p $< .05$
4.	Poor listening skills after age two	$\chi^2 = 9.22$ p $< .01$
5.	Ease of mother-child communication	$\chi^2 = 16.50$ p $< .01$
6.	Temper tantrums	$\chi^2 = 6.26$ p $< .05$

FACTORS DIFFERENTIATING EH AND SA SUBJECTS:

1.	Tapped patterns	W.* p of $z \leq -2.175 = .015$
2.	Right - Left discrimination	W.* p of $z \leq -2.14 = .016$
3.	Double simultaneous touch (face-hand test)	$\chi^2 = 6.23$ p $< .05$
4.	Fast alternating finger movements	$\chi^2 = 4.54$ p $< .05$
5.	Fast alternating hand movements	$\chi^2 = 7.20$ p $< .01$

FACTORS NOT DIFFERENTIATING EH AND SA SUBJECTS:

1. Measures of hand, foot and eye preference
2. Adventitious overflow movement
3. Arm extension test
4. Walking on balance beam

* Wilcoxon matched-pairs nonparametric